DOCUMENT RESUME

ED 258 880 SO 016 611

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TITLE Preparing Students for Humanity's Latest Adventure--Conquering Space. How to Do It in the Social Studies Classroom. Series 4, Number 1.
INSTITUTION National Council for the Social Studies, Washington, D.C.
PUB DATE [85]
NOTE 13p.; For other issues in the "How to Do It" series, see SO 016 609-613.
AVAILABLE FROM National Council for the Social Studies, 3501 Newark St., N.W., Washington, DC 20016 (1-9 copies, $2.00 each; quantity discounts available).
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Class Activities; Conflict; Economic Factors; Economics Education; Elementary Secondary Education; History Instruction; Information Sources; International Cooperation; International Trade; Manufacturing; Political Issues; Resource Materials; Social Problems; *Social Studies; *Space Exploration; Teaching Guides; United States Government (Course); World Problems
IDENTIFIERS Ownership; *Space Colonization; Space Travel

ABSTRACT

Background information and resources to help K-12 social studies teachers prepare today's youth to cope with the problems that conquering space is sure to bring are provided in this guide. The first part of the guide focuses on political, social, and economic issues that may arise as humans attempt to conquer space. Discussed are the international scene, potential political structures, space revolts, who will go into space, whether there is anyone else out there, the ownership of space, manufacturing in space, and galactic trade restrictions. The second part of the guide contains nine activities dealing with space exploration and conquest that can be used in world history, government, civics, and economics classes. Examples of the activities follow. Students design an international regime, choose space pioneers, decide what role the United Nations should play in human activities in space, and write a constitution for a space colony that has just won its independence from earth. The guide concludes by listing the NASA centers and organizations and publications where teachers can find information about human activities in space. (RM)

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How To Do It

IN THE SOCIAL STUDIES CLASSROOM

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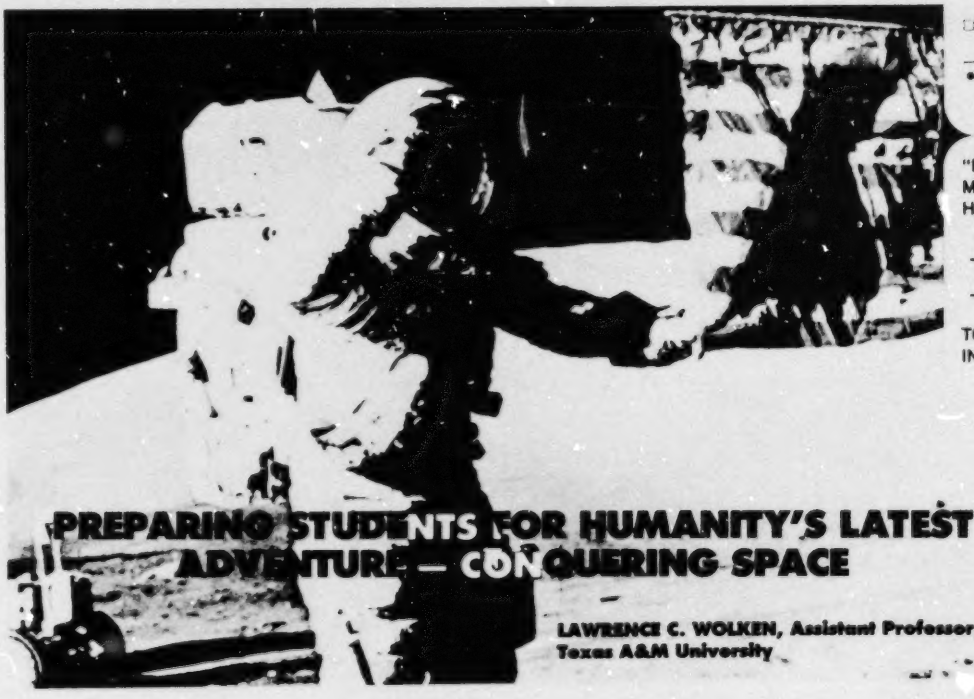

PREPARING STUDENTS FOR HUMANITY'S LATEST ADVENTURE — CONQUERING SPACE

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The horse and buggy days of the turn of the century seem impossibly long ago. In just eighty years technological advances have ushered in the automobile, the atom bomb, and the jet plane and have made it possible to land an astronaut on the moon and to begin to probe the outer reaches of our solar system. What will happen between now and the advent of the twenty-first century? While many of the possibilities seem more like science fiction than fact, one thing is certain. As humans continue to explore space and begin to discover ways of exploiting its resources, many problems will arise. They will be broad in scope, encompassing all aspects of human behavior. Are we bound to repeat the mistakes of the past? Or can we prepare today's students to apply the lessons of history to the conquest of the heavens?

The task of preparing today's youth to cope with the problems which conquering space is sure to bring is a farsighted educational undertaking, which can stimulate understanding of the past, as well as the future. The social studies classroom is a natural place to study such problems. To assist teachers in this effort, this guide focuses on some of the political, social, and economic issues which are bound to arise as humans attempt to conquer space. Because of the broad scope of these issues, this topic can be incorporated effectively into history, government, civics,

SO 016 611

The How To Do It Notebook series 4, designed for a loose leaf binder, provides a practical and useful source of classroom methods and techniques for elementary and secondary social studies teachers. The series is published by the National Council for the Social Studies, 3501 Newark Street, N.W., Washington, DC 20016. Additional copies: 1–9 copies, $2.00 each; 10–49 copies, $1.60 each; 50–99 copies, $1.40 each; 100–499 copies, $1.20 each; 500–999 copies, $1.00 each; 1000 or more, $.80 each.

and economics courses. When discussing the exploration and colonization of space, teachers should emphasize to students that the problems which they are considering have no single, simple solutions. This guide is therefore designed to take students beyond simply absorbing a large body of facts and figures. It is intended to stimulate thinking and to provide an opportunity for students to apply their problem-solving skills to situations which they may encounter as adults. It encourages students to draw upon their knowledge about and understanding of social institutions, both past and present. Its subject – the conquest of space – has the special advantage of generating a great deal of student interest. This guide:

- Provides background information on human activities in space.
- Identifies specific political, social, and economic problems associated with living in space.
- Describes activities designed to focus student attention on specific issues.
- Lists sources of information and educational materials available on human activities in space.

THE INTERNATIONAL SCENE

While the United States and the Soviet Union presently dominate the space race, many nations around the world recognize the issues which the exploration of space raises for the human race. This awareness has resulted in many discussions at the United Nations. One of the first international agreements to emerge from the U.N. was the 1966 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space. The signatory nations agreed to explore and use outer space for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development. They agreed not to place weapons of any kind in earth orbit. The treaty also established the principle that each government is responsible for authorizing and supervising all of its space activities, regardless of whether they are run by the government or by private citizens of that country.

This treaty was followed by an agreement in 1968 whereby nations with space-flight capabilities would cooperate in rescuing astronauts from other countries and returning them safely to earth.

As the number of objects launched into space increased, concern grew about the damage that might result if one of these objects did not completely disintegrate when it reentered the earth's atmosphere. In 1972, the United Nations established international rules and procedures identifying a country's liability for damage caused by an object which it launched into space. In an effort to keep track of the man-made objects orbiting earth, a U.N. convention in 1975 agreed upon a system for registering objects launched into space.

The most comprehensive United Nations treaty to date was opened for signatures in December of 1979. Article XI of the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies — commonly referred to as the Moon Treaty — contains the most important parts of this treaty (see page 12). (In this document, references to the moon signify all celestial bodies in our solar system.)

POLITICAL ISSUES

From a political point of view, future conquest and actual colonization of space raise the fundamental question of who will have jurisdiction in this new territory. So far, all human activities beyond the earth's atmosphere have been conducted as a part of a governmentally controlled program, either in the United States or the Soviet Union. Even though both countries have sent civilians into space, the activities of astronauts and cosmonauts are determined by their respective governments. In the event of true colonization, however, a wide variety of political structures will become possible.

Central to this issue is the question of whether space colonies should be ruled from earth or should be allowed to govern themselves. Since humanity is currently confined to the earth, it is only natural that the earth would be the sentimental favorite to rule the solar system. However, when human beings begin living in space, their loyalties are likely to change. Someone born and raised on the moon, Mars, or an asteroid may not wish to be ruled by men and women on earth. At some time in the future, a new nationalism in space may challenge terrestrial governments.

Potential Political Structures

One hypothetical political structure for a settlement in space is outlined in Article XI of the Moon Treaty. The international regime which this treaty seeks to establish would be dominated, at least initially, by representatives from earth. In theory, such a regime would help coordinate human efforts and would attempt to insure the peaceful colonization of space. Paragraph 7 commits the regime to a policy of managing the solar system's resources in a rational way and to making certain that the benefits resulting from space are shared equitably among all nations on earth. Some who are concerned about individual liberty believe that such a regime would be an excessively powerful government, if it were given the means to enforce its decisions. In addition, from a practical standpoint, one must wonder how efficiently the large bu-

reaucracy needed by such a regime would perform.

It would also be possible for each country actively involved in colonizing space to govern its own extraterrestrial territories. This could lead to the establishment of a great diversity of political institutions from Mercury to Pluto. Individual countries would be responsible for whatever happened within their colonies. Because people would not be likely to leave their nationalistic tendencies back on earth, this scenario would probably involve conflicts between nations as they tried to expand their spheres of influence. Earth's developing nations would also be excluded — at least at first — from actively participating in the conquest of space. Those nations which currently have the technology to operate beyond the earth's atmosphere would have a head start on the other nations and would probably try to establish themselves in the "best" territories which space has to offer.

A third possibility is that private corporations would operate in space independently of any nation. Once the technical problems of travelling and living in space are solved, the vastness of our solar system could offer companies the opportunity to establish their own small bases on planets, moons, or asteroids which are outside the territorial jurisdiction of any nation. In this case, company towns on earth might prefigure the cities of the future.

It is even conceivable that some space communities could be ruled by the strongest, most powerful individual in that area. Such a situation was not unheard of in frontier towns in America. One might speculate that the farther a space colony was from civilization, the more likely it would be to be ruled locally and not by a distant government. Some towns might even develop for the express purpose of providing a refuge for the Barbary pirates of the future.

Space Revolts

Merely using the term "colonizing" space suggests that extraterrestrial communities of the future will be controlled by nations on earth. As long as these communities are dependent upon supplies from earth for their survival, such a relationship seems likely. Because the resources available on earth are also available in vast quantities throughout the solar system, however, scientists and engineers see no reason why people living in space cannot become completely self-sufficient. In fact, when these resources become easily accessible to humans and the technology to use them is developed, the people on earth are likely to become dependent upon their colleagues in space. It seems only logical, then, that at some point in time these colonies would want their political independence from earth. Revolutions against the earth-based mother countries may be the inevitable future for space colonies.

No matter what types of political institutions are adopted as people leave the earth, they will have to deal with the same problems which exist today. How, for example, will laws be made within each political unit? Who will enforce these laws? How will the political unit protect itself from other groups of humans? Answers to these questions will involve the role of police and military forces in space. Military strategists have long recognized the advantages of placing both offensive and defensive weapons in earth orbit. As a result, many discussions in the United Nations have focused upon ensuring the peaceful development of space. While agreements outlawing the military use of space have a great deal of popular appeal, some feel that it is naive to suppose that military forces and weapons of destruction will be restricted to the surface of the earth. While space travel requires a high level of intelligence and knowledge, these qualities may not necessarily be associated with the capacity to secure peaceful existence. Some people hope that the future will see the development of new mechanisms by which individuals and nations can peacefully settle their differences; others fear that human beings are doomed to repeat the bloody history of the past in their conquest of space.

SOCIAL ISSUES

To some extent, the future conquest of space may parallel America's pioneer history, when rugged individualists pushed the wilderness frontier westward across the continent. These men and women were self-sufficient, preferred plenty of elbow room, and were free to do as they chose. The vastness of space may become as attractive a lure to future generations as the New World was to the explorers and early colonists. One should realize, however, that only a few were brave enough to risk their lives by leaving the comfort and security of home to face the unknown. Many of the early colonists were people who believed that risk was an essential part of living and felt that America offered them opportunities unavailable in their homeland. Just as there were those in the past who were willing to accept the risks of moving to the New World, there are those today who view space as a new frontier, a new challenge, and a new hope for humanity.

Who Will Go?

Conquering space, however, will not be easy and will not appeal to everyone. The exciting exploits of Luke Skywalker tend to glamorize the exploration of space and ignore the harsh realities which space pioneers will

actually face. The vacuum of space presents future colonists with a much more hostile environment than that faced by our ancestors. Even on planets which have an atmosphere, humans will need to erect elaborate life-support systems. Space colonists will not be able to live off the land as the pioneers of the past did.

Some sociologists and anthropologists believe that the habitats which humans will have to build to survive in the hostile environment of space will necessitate new social structures. In these habitats, each individual would be a potential threat to the entire community. If a saboteur were to damage the colony's life-support system, everyone could be killed. For this reason, the physical security of the space habitat and its support equipment would necessarily be a top priority of whatever organizational structure the colony were to adopt. There are many possibilities. At one extreme, space colonies may be run like military bases, in which individual freedom would be severely limited. Alternatively, colonists may choose to place important equipment in a section of the space habitat that could be closely guarded, while allowing freedom of movement elsewhere. Or they may decide to trust each other and not worry about the possibility of a saboteur bent on destroying the colony. After all, cities on earth do not guard their water supplies.

Is Anyone Else Out There?

Only recently has the human race begun seriously to consider whether there may be intelligent life elsewhere in the universe. What will happen when the "first encounter" occurs? Possible responses range from "shooting first and asking questions later" to cementing instant friendship. Two closely related questions are currently receiving attention. Should mankind actively search for extraterrestrials? Should we take steps to let the rest of the universe know of our existence? Considerable controversy surrounds both questions.

Within the scientific community, SETI (rhymes with jetty) stands for the Search for Extraterrestrial Intelligence. There is little doubt that the discovery of extraterrestrial intelligence would be of great philosophical, social, and scientific importance to the human race. One SETI experiment will leave our solar system on Pioneer 10 and Pioneer 11, the spacecraft which made humanity's first "close encounters" with Jupiter and Saturn during the 1970s. Each spacecraft carries an engraved message from earth to any inhabitants of another star system who might discover them drifting through interstellar space (see Figure 1).

Not everyone is happy about SETI experiments. Some maintain that the lack of evidence of extraterrestrial life within our solar system suggests that advanced societies have not evolved elsewhere in our galaxy. (A few even contend that there is no evidence of intelligent life anywhere—including the earth.) These skeptics feel that SETI efforts are a waste of time and money. Proponents counter that the absence of evidence is not evidence of the absence of extraterrestrials.

Another aspect of the question of intelligent extraterrestrial life concerns the wisdom of announcing our presence to the rest of the galaxy. Some fear that human beings may be considered a delicacy by aliens, or that a technologically superior civilization may enslave earth's inhabitants if it becomes aware of our existence. They would prefer that life on earth remain a well-guarded secret. If human history is an accurate reflection of the behavior of civilizations everywhere, perhaps these warnings should be taken seriously. Or is it presumptuous on our part to assume that species evolving elsewhere in the galaxy would be similar to humans socially, biologically, or in any other way?

ECONOMIC ISSUES

During the first quarter century of the Space Age, activities in space were publicly financed. The National Aeronautics and Space Administration, for example, directed America's efforts. In recent years, however, the private sector has become increasingly involved in human activities in space. Many of the communications satellites currently orbiting the earth are owned and operated by private companies. Even NASA's monopoly on launch facilities is being challenged. In September, 1982, Space Services, Inc., a Houston-based firm, successfully launched its own rocket on a ten-minute test flight. SSI hopes to develop the capability of placing payloads in orbit and intends to compete with NASA for customers.

Who Owns Space?

As more and more people venture into space, questions will inevitably arise concerning the roles of the private and the public sectors. Answers to these will depend in part upon our answer to the question, "Who owns space?" The question of property rights has already generated heated debates in the United Nations. The Moon Treaty, for example, declares that "the moon and its natural resources are the common heritage of mankind." This statement seems to establish the principle that space belongs to everyone on earth and is, therefore, public property in the broadest sense. This view is consistent with the treaty's intent to establish an international regime "to govern the exploitation of the natural resources" of space. Many of the developing nations on earth support this approach because they believe that it protects their inter-

ests. They fear that if countries and individuals are allowed to claim ownership of planets, moons, and asteroids, only those possessing space-flight capabilities will reap the economic benefits resulting from colonizing space. Lacking this capability, developing nations fear that they will not receive any of the benefits that space has to offer.

Those who oppose the treaty feel that barring private ownership from space will discourage participation by private firms in the development of extraterrestrial resources. It is unlikely, for example, that a company would go to the expense of exploring possible mining sites on the moon if it would be prohibited from owning, and therefore profiting from, anything it might find. Such a system would encourage everyone to sit back and wait for someone else to bear the initial costs and risks involved in developing the resources of space. Opponents are concerned about the power that the treaty's international regime would have to be given if it were to be successful in governing human activities in space.

Perhaps someone could come up with a novel approach that would be acceptable to proponents of public and private ownership alike. One way might be to divide the moon into as many equal parts as there are nations currently in existence on earth. A random drawing could then be held to determine which piece of the moon each nation would receive. A nation would then determine what type of property rights would exist on its lunar homestead. If it wished to sell pieces of property to individuals, firms, or other countries, it could do so. Some nations might choose to retain possession of their lunar territories and use the economic benefits derived from them for the good of their earthbound citizens. Countries which currently do not have space-flight capabilities might decide to lease part or all of their lunar territories to other nations for a specified period of time. Whatever happens, property rights are certain to play an important role in shaping the economic environment that will prevail in space.

Manufacturing in Space

While scientific curiosity was the primary impetus for the initial excursions into space, many believe that the potential for economic rewards will ultimately be the incentive for large numbers of people to leave earth. Earthbound businesses are just beginning to realize some of the advantages offered by the vacuum of space and its zero gravity. The McDonnell Douglas Corporation and Johnson and Johnson, for example, are cooperating in a joint venture to produce drugs in space using a process called electrophoresis. They hope this process will produce 700 times the volume of materials, with four times the purity of those made on earth. This translates into lower costs and higher quality for consumers. One drug being considered is interferon, which can be used to treat viral infections and may even be effective in fighting cancer. A study conducted by Rockwell International concluded that producing interferon in space could lower its cost to consumers from the current price of $21 per dose to $1.40 by 1995. If so, this could become an $897 million industry, serving over 10 million patients. Beta cells are another biological material which may be produced in space. Because they cannot be produced on earth in sufficient quantities, production in space could open up an estimated market of 600,000 patients. Beta cells may even prove to be a one-injection cure for diabetes.

Many companies in the United States have already purchased cargo space on the Space Shuttle to conduct experiments in an effort to learn more about manufacturing products in space. President Reagan proposed in his 1984 State of the Union address that NASA develop a fully operational earth-orbiting space station by 1991, at a cost of $8 billion. One of the major purposes of this project is to provide earthbound companies with a permanent manufacturing facility outside of the earth's atmosphere. A firm would be able to lease space on this facility and send up its own technicians to monitor the production process. Alternatively, a fully automated module could be attached to the outside of the space station, and the company could rent an astronaut for a few hours each week to remove the finished product from the module and send it back to earth on the next shuttle flight. The Soviets have been active in this area for several years. Much of the time that Soviet cosmonauts have spent aboard their Salyut space station has been devoted to experimenting with a wide variety of space manufacturing techniques. It will be several years, however, before men and women on earth begin receiving products with a "made in space" label.

Galactic Trade Restrictions

Once products manufactured in space begin reaching markets on earth, will trade frictions develop? In the case of products which cannot be produced on earth, there will probably not be conflicts. However, when space-based manufacturers begin competing directly with earth-based producers, it seems likely that terrestrial companies will appeal to their governments for protection against imports from space. If or when colonies in space become self-sufficient and win their political independence from earth, this situation may be reversed. Industries on the moon may ask their newly formed lunar government to protect them for a short period of time from competition with well-established manufacturers on earth. These infant industries

might promise to use this time to improve their production processes and lower their costs. Thus, protectionism may influence humankind's economic activities in space.

HISTORICAL PERSPECTIVE

Even though venturing into space is a new experience for the human race, the political, social, and economic issues which are bound to arise during this adventure are as old as history. It is therefore important for students to realize that the experiences of the past can provide valuable information about the problems which the future may pose.

Exploring the New World

Initially, Spain and Portugal were the only two countries involved in the exploration and colonization of the New World. In 1493, Pope Alexander VI established the Papal Line of Demarcation in an effort to settle territorial disputes between the two world powers. During the centuries that followed, countries from all over Europe and even people from the Orient became involved in the settlement of the Americas. Many wars were sparked by territorial disputes. The first contacts between Europeans and Indians in the Americas were far from peaceful. The early exploration and colonization of the New World were financed primarily by governments. As more people became interested in the opportunities available across the Atlantic, they turned to the private sector for the finances needed to develop the resources of the New World. Colonies in the New World had to revolt in order to win their independence.

It is often tempting to criticize our ancestors for the mistakes they made. Students should, however, be reminded that not all of their decisions turned out to be wrong. Conquering space will provide today's students with the opportunity to find new, innovative, and — it is hoped — better approaches to the problems which have plagued the human race throughout history. Just as the New World offered our ancestors a chance to develop institutions different from those which existed in Europe, space offers a new generation a real opportunity to improve upon the political, social, and economic institutions which currently exist on earth.

ACTIVITIES

The nine activities which follow are intended to focus students' attention on specific issues and concepts as they relate to efforts by the human race to conquer outer space. The topics considered here are all fundamental to various areas of traditional social studies education. The exercises are designed to provide students with an opportunity to expand and apply their knowledge of history, economics, government, and human behavior in the fresh context of space exploration and conquest. Through these activities, students will sharpen basic social studies skills. They will increase their knowledge, practice solving problems, and exercise their ability to think critically.

Materials suggested for each activity are described fully in the next two sections of this How To Do It guide. Where to Find Information About Human Activities in Space describes the NASA films named here and tells how to obtain them for classroom use. The Publications section lists the printed materials that are suggested, with complete bibliographical references and brief annotations.

1. Expansionism vs. Isolationism

Class: World History, American History
Key Question: Should human beings stay on earth, or should they try to expand their influence throughout the galaxy?
Key Idea: The destiny of mankind means different things to different people.
Objectives: Students should:

1. Distinguish between expansionist and isolationist philosophies.
2. Identify specific examples of isolationism and expansionism in human history.
3. Discuss the consequences of isolationism and expansionism.
4. Express and support their opinions about the destiny of the human race.

Time: 1–2 class periods.
Materials: World history or American history textbook, "Planetary Scientists Fight Funding Cuts," "The Tragedy of the American Space Program," "Are the Soviets Ahead in Space?" and the movies *Eagle Has Landed: The Flight of Apollo 11* and *The Mission of Apollo Soyuz.*

This exercise can be used as either a written or an oral activity. Ask each student to take a stand on whether or not the human race should try to expand its influence throughout the galaxy. This opinion should be supported by facts from specific periods in history and should include a discussion of the consequences (both positive and negative) of a society pursuing a policy of isolationism or expansionism. Whenever possible, point out ways in which basic social, political, and religious beliefs may influence an individual's stand on this issue.

2. Governing Human Activities in Space

Class: World History, Government, Civics
Key Question: How should human activities in space be governed?
Key Ideas:

1. No perfect way of controlling human activity in space exists.
2. Institutions on earth will control human activity in space initially.

Objectives: Students should:

1. Compare the advantages and disadvantages of different ways of governing human activities in space.
2. Consider potential problems which might arise depending upon which approach is adopted.

Time: 1 class period.
Materials: The Exploitation and Colonization of Space: Lessons from History.

Briefly describe the three major forms of political control for space settlements which are discussed in this guide — government by an international regime, by separate terrestrial nations, and by private corporations. Each student should choose two of these and write a short essay comparing the advantages and disadvantages of each and discussing at least one potential problem which might arise under each. Each student should decide which one seems "best" for colonizing space and which one seems most likely to occur. Determine if there is a consensus within the class.

3. Designing an International Regime
Class: World History, Government
Key Questions: If an international regime is established to control the development of extraterrestrial resources, what form should it take?
Key Ideas:
1. Powers granted to an international regime would reduce the freedom and power of national governments and individuals.
2. A wide variety of governmental structures are possible.

Objectives: Students should:
1. Realize the difficulty involved in deciding what powers such a regime should have.
2. Identify different groups who might control such a regime.
3. Describe different ways in which the regime's decisions could be enforced.
4. Expand their perspective on political institutions on earth.

Time: 3 class periods.
Materials: Article XI of the Moon Treaty.

Have the class read paragraph 5 of the Moon Treaty which provides for the establishment of an international regime "to govern the exploitation of the natural resources" of space. Let the class act as a United Nations committee which has been assigned the task of designing the framework for the regime. The class should spend one period on each of the following issues:
1. Who should control the regime? (Should a group of people who are elected or appointed control it? Which countries should be represented? Would the U.N. serve as a good model?)
2. What powers should the regime have?
3. How should the regime's decisions be enforced?

4. Choosing Space Pioneers
Class: American History, World History, Civics
Key Question: What qualifications should individuals have to be members of an ideal space colony?
Key Idea: Advantages and disadvantages exist in selecting space colonists in an effort to improve society.
Objectives: Students should:
1. Identify the types of people they would like to live with and explain why.
2. Identify specific tasks required for their community to function properly.
3. Discuss the issue involved in using a selection process in order to improve society.

Time: 3 class periods.
Materials: "The First Martians," "Vesta: A World of Its Own," *The High Frontier: Human Colonies in Space, Space Settlements,* and the movies *Four Rooms—Earth View* and *Space Shuttle—A Remarkable Flying Machine.*

Divide your class into five groups. The task of each group is to determine selection criteria for choosing the space pioneers who will accompany them in establishing a new colony on a large asteroid. The initial colony will consist of 1,000 people who will become the first generation of a permanent expanding base. Assume that the technology exists to allow the colony to be self-sufficient. The students should determine qualifications which will serve as minimum standards which a specific number of people representing various segments of the population must meet in order to be accepted for the colony. At the very least, each group should consider how many males and females to accept, the age distribution of the settlers, and their educational backgrounds. Since potential applicants can come from anywhere on earth, such things as nationality, race, religion, political philosophy, criminal background, and general health should be considered. Students should examine their own communities and determine the types of people they would like to include in the space colony. Each group should decide if the people chosen will reflect the general make-up of cities on earth or be selected in an effort to improve society. If students choose the latter course of action, they should be specific concerning the types of improvements which they see as desirable. Each group must also decide which plants and animals it would like to take with them and which ones (roaches, flies, and mosquitoes for example) it will exclude from the colony.

The suggested material should be used to introduce this activity. Explain to the class what it might be like living in space. Once all the groups have agreed upon their selection criteria, ask each group to share its conclusions with the rest of the class.

5. Investigating a United Nations Document
Class: World History, American History, Civics
Key Question: What role should the United Nations play in human activities in space?
Key Idea: The interests of the United States, other nations, and the United Nations are not necessarily the same.
Objectives: Students should:
1. Read an official U.N. document.
2. Determine if the document is in the best interests of the United States.
3. Identify issues which they feel should be settled by an international treaty.
4. Realize that nations have different interests.

Time: 2–5 class periods
Materials: Three U.N. documents relating to space.

A month before you plan to use this activity, choose three students to write to the United Nations requesting different conventions or treaties mentioned in this guide. (address: United Nations, Treaty Section, New York, NY 10017). If these students use school stationery, the U.N. usually does not charge for the documents. Once the documents arrive, divide the class into three groups, each taking one document. Have students read and discuss the contents of the agreement, considering such questions as:

In what ways would this treaty be beneficial to the United States? Detrimental?

In what ways would it be beneficial to the world as a whole? Detrimental?

To extend this activity, have the class choose an issue that it feels should be settled by a United Nations treaty. Possibilities include the role of the military in space, the enforcement of laws in space, and a protocol for encounters between humans and extraterrestrial beings. The class should then write a treaty covering that issue. Class members should represent different countries in the U.N. This role-playing will provide students with the opportunity to realize that the interests of countries like the United States, the Soviet Union, and developing nations may conflict.

6. "Close Encounters"
Class: World History, American History, Civics
Key Question: How would you describe humans to an extraterrestrial being?
Key Idea: Humans exemplify a wide range of characteristics, some good and some bad.
Objectives: Students should:
1. Use their knowledge of history to describe the human race.
2. Realize that we are probably not alone in the universe.
3. Identify specific human characteristics.
4. Enhance their awareness of the global community.

Time: 2 class periods
Materials: The Pioneer Plaque (Figure 1 in this guide), "The Search for Extraterrestrial Intelligence," "Searching for THEM: Interstellar Communication," "Life on Europa?" and the movie *Who's Out There?*

These materials will serve to introduce students to current scientific thinking concerning extraterrestrials. Have each student write a four-page essay describing the human race to an extraterrestrial during the first "close encounter" with an alien intelligence. Students willl have to decide how truthful they want to be with the alien (hiding certain facts about humanity may be desirable), and whether they want to focus on the positive or negative aspects of humans. This exercise will provide insights into each student's perceptions of his or her fellow human beings and their knowledge of the real world and history.

7. Constitutional Convention
Class: American History, World History, Government
Key Question: What type of government should be established in a space colony that has just won its independence from earth?
Key Ideas:
1. Space colonists will have the opportunity to establish whatever form of government they want when they become independent.
2. In deciding the type of government they want, space colonists can learn a great deal from past experiences with different political organizations.
3. A wide variety of political organizations are possible, each with its advantages and its disadvantages.

Objectives: Students should:
1. Critically examine several different forms of political organization.
2. Become aware of the strengths and weaknesses of a democracy.
3. Consider the U.S. Constitution, Bill of Rights, Amendments, and Supreme Court decisions in their effort to draft an ideal constitution.
4. Realize that history can provide insights into what is likely to happen under different forms of political organization.
5. Address the issue of governmental power versus individual freedom.

Time: 3–5 class periods

Prepare the class members to act as delegates to the constitutional convention for a confederation of 13 space colonies which has recently won its independence from earth. The delegates' task is to design the government that will rule their new country. There are no restrictions upon the forms of governmental organization which they may consider. They may want to pattern their new government after a historical example, or they may

want to try to develop an entirely new form of government. The following questions will help them get started:

Who will be allowed to participate in the political decision-making process? (Everyone? Only those who fought in the revolution? Anyone over 30? Only those who own property?) Or will the leader of the military be the ruler?

What powers will the national government have relative to the 13 colonies?

What branches will the government have, and what powers will be exercised by each of them?

What will be the relationship between the military and the government?

What rights will individuals in society have?

Who will be allowed to become a citizen of the country?

How will the 13 colonies decide whether or not to adopt the form of government recommended by the convention?

The teacher may act as the leader of the convention or may allow a student to fill that role. The leader must maintain order and try to get everyone in class involved in the discussions. Students should support their opinions with facts from current or historical examples whenever possible.

8. Economic Implications of the Moon Treaty

Class: Economics

Key Question: What are the economic implications of the Moon Treaty?

Key Ideas:

1. The Moon Treaty expresses specific economic ideas concerning ownership of property in space and the redistribution of any wealth resulting from developing the resources of space.
2. The resources of space offer mankind the opportunity to improve the standard of living of humans on earth.
3. Private enterprise may be discouraged from operating in space if an international regime is established.
4. The type of property rights which exist in space will influence the way its resources are developed.

Objectives: Students should:

1. Analyze the economic implications of the Moon Treaty.
2. Decide if extraterrestrial resources should be owned privately, publicly, or some combination of the two.
3. Identify several ways in which the resources of space might help to improve living conditions on earth.
4. Compare the control and the use of public property to private property.

Time: 2–4 class periods

Materials: Article XI of the Moon Treaty, *Space Manufacturing 1983*, and "Economic Issues of Colonizing Space."

Use the information in the suggested materials to explain to students some of the possible uses of extraterrestrial resources to improve living conditions on earth. Have students read Article XI of the Moon Treaty and analyze its economic implications. In doing so, they should consider the following:

What is meant by the term "common heritage" as used in the Treaty?

What are the implications of the main purposes (7b and d) of the international regime?

What type of property rights should exist in space?

In what ways might property rights encourage or discourage the development of the resources of space?

Should the United States sign the Moon Treaty?

9. Gallactic Trade Restrictions

Class: Economics, World History

Key Question: Are trade restrictions likely to develop between earth and extraterrestrial countries?

Key Ideas:

1. Throughout history, a variety of arguments have been used to justify trade restrictions.
2. Some people benefit from trade restrictions while others are adversely affected.

Objectives: Students should:

1. Explain several arguments commonly used to justify trade restrictions.
2. Identify specific groups who benefit from trade restrictions and those who are adversely affected.
3. Understand the concept of comparative advantage as it relates to the benefits of trade.

Time: 1 class period

Instruct your students that they are members of a space colony which has recently won its independence. Many of the domestic industries of the young country are just now developing. Lead the class in a discussion of the arguments which might be used to justify trade restrictions. The discussion should take into account arguments concerning defense, infant industries, cheap foreign labor, and domestic employment. Introduce the concept of comparative advantage. (A country benefits from its "comparative advantage" in the marketplace when it specializes in the manufacture of products which it can produce more cheaply than another country.) Have the students determine who would benefit and who would be adversely affected if trade restrictions were imposed on a specific product. For example, suppose terrestrial authorities placed a high tariff on solar energy produced inexpensively in space and beamed to earth by microwaves.

WHERE TO FIND INFORMATION ABOUT HUMAN ACTIVITIES IN SPACE

NASA CENTERS

The seven centers of the National Aeronautics and Space Administration listed below offer a wide variety of printed materials and films prepared for use in secondary schools. Contact the center in your area for further information.

If you live in:	*Write to:*
Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont	NASA Goddard Space Flight Center Public Affairs Center Code 130 Greenbelt, MD 20771 (301)344-8101
Alaska, Arizona, California, Hawaii, Idaho, Montana, Nevada, Oregon, Utah, Washington, Wyoming	NASA Ames Research Center Public Affairs Office, 204-12 Moffett Field, CA 94035 (415)956-6270
Alabama, Arkansas, Iowa, Louisiana, Mississippi, Missouri, Tennessee	NASA George C. Marshall Space Flight Center Public Affairs Office, CA-20 Marshall Space Flight Center, AL 35812 (205)453-0040
Florida, Georgia, Puerto Rico, Virgin Islands	NASA John F. Kennedy Space Center Public Affairs Office Code PA-EAB Kennedy Space Center, FL 32889 (305)867-4444
Kentucky, North Carolina, South Carolina, Virginia, West Virginia	NASA Langley Research Center Mail Stop 185—Technical Library Hampton, VA 23655 (804)865-2634
Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin	NASA Lewis Research Center Film Service Dept.-22 21000 Brookpark Road Cleveland, OH 44135 (216)433-4000, ext. 708 (For further information only)
Colorado, Kansas, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas	NASA Lyndon B. Johnson Space Center Public Information Branch/AP3 Film Distribution Library Houston, TX 77058 (713)333-4980

Contact the appropriate Center for the free loan of the following NASA films, which are particularly effective in bringing the exploration and colonization of space into the classroom:

Eagle Has Landed: The Flight of Apollo 11 (HQ-194) 28 min.
The story of the historic first landing of astronauts on the moon in July, 1969, depicting the principal events of the mission from the launching through the post-recovery activities of the Astronauts Armstrong, Aldrin, and Collins.

The Mission of Apollo Soyuz (HQ-256) 28 min.
The Apollo Soyuz mission set a precedent for international manned space flight. The film covers this mission and concludes with a projection on future international cooperation in space.

Space Shuttle—A Remarkable Flying Machine (HQ-318) 30 min.
Viewers are taken through the successful maiden voyage of the Space Shuttle Columbia, the world's first reusable spaceship.

Four Rooms — Earth View (HQ-239) 28 min.
Narrated by actor E.G. Marshall, this film tells the story of the three Skylab missions, the nine astronauts, who were involved, and their 171 days aboard America's first space station.

Who's Out There? (HQ-226) 28 min.
Orson Welles takes viewers from the monstrous Martians of his famous 1938 radio broadcast, "The War of the Worlds," to the views of extraterrestrial life, which are based upon information from probes to investigate our solar system.

ORGANIZATIONS

The Planetary Society, 110 S. Euclid Avenue, Pasadena, CA 91101
The largest organization interested in space, the Planetary Society has raised funds to help support several scientific

projects, including a SETI program conducted at Harvard University's Oak Ridge Radio Observatory. The Society is also exploring the possibility of human activity on Mars. Educational materials available include books, posters and slides of the planets taken during various NASA missions, and a bimonthly publication, *The Planetary Report*.

National Space Institute, West Wing, Suite 203, 600 Maryland Ave., S.W., Washington, DC 20024 (202)484-1111
The National Space Institute was originally established by Werner Von Braun and is dedicated to human presence in space. It publishes an informative monthly magazine, *Space World*.

L-5 Society, 1060 E. Elm, Tucson, AZ 85719
The L-5 Society was formed in 1975 with the purpose of promoting space development in the governmental, industrial, and private sectors. Slides depicting artists' conceptions of space colonies, books on colonizing space, and a monthly publication, *L-5 News*, are available.

PUBLICATIONS

Astronomy, Astro Media Corp., P.O. Box 92788, Milwaukee, WI 53202.
This monthly magazine is written for the layman, contains excellent photographs and artwork, and is available in many high school libraries or science departments.

Berry, Richard, "Planetary Scientists Fight Funding Cuts," *Astronomy*, January, 1982, pp. 24–32.
Discusses recent cuts in NASA's budget.

Cordell, Bruce M., "The First Martians," *Astronomy*, March, 1983, pp. 6–17.
Describes a possible manned mission to Mars.

Deudney, Daniel, *Space: The High Frontier in Perspective*, 1982, World-watch Institute, 1776 Massachusetts Avenue, N.W., Washington, DC 20036.
This informative booklet discusses issues from the role of the military to space industrialization.

Hartman, William K., "Vesta: A World of Its Own," *Astronomy*, February, 1983, pp. 6–13.
Describes asteroids and ways they could be used by humans.

Lago, Don, "The Tragedy of the American Space Program," *Astronomy*, November, 1983, pp. 24–28.
Reviews the causes of the decline in U.S. space efforts.

Mood, Stephanie, "Life on Europa?" *Astronomy*, December, 1983, pp. 16–22.
Discusses the possibility of life on one of Jupiter's moons.

O'Neill, Gerard, K., *The High Frontier: Human Colonies in Space*, 1982, Garden City, NY: Anchor Books.
O'Neill describes what it may be like to live and work in space.

Pike, John, "Are the Soviets Ahead in Space?" *Astronomy*, February, 1982, pp. 28–30.
Compares the U.S. and Soviet space programs.

Sagan, Carl, and Drake, Frank, "The Search for Extraterrestrial Intelligence," *Scientific American*, May, 1975, pp. 80–89.
Includes a description of the radio message sent from the Arecibo Observatory and explains the message appearing on the Pioneer plaque.

Science News, Subscription Dept., 231 West Center Street, Marion, OH 43302 (New subscribers can call toll free: 1-800-247-2160).
Written for the layman, this weekly magazine is an excellent source of current information concerning activities in space. It is available in many high school libraries or science departments.

Space Manufacturing 1983, Vol. 53, Advances in Astronautical Sciences, an American Astronautical Society Publication, available from Univelt, Inc., P.O. Box 28130, San Diego, CA 92128.
Discusses many aspects of space manufacturing.

Space Settlements, NASA SP-413, Stock No. 033-000-00669-1, Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.
This booklet summarizes the findings of a study investigating the feasibility of colonizing space.

Tarter, Jill, "Searching for THEM: Interstellar Communication," *Astronomy*, October, 1982, pp. 6–22.
Estimates the probability of extraterrestrial life and describes recent SETI projects.

Wolken, Lawrence C., *The Exploration and Colonization of Space: Lessons from History*, 1980, Center for Education and Research in Free Enterprise, Texas A&M University, College Station, TX 77843.
This booklet discusses some of the political, economic, and social problems likely to arise as mankind becomes more active in space and looks at these issues from a historical perspective.

Wolken, Lawrence C., and Fraser, Donald R., "Economic Issues of Colonizing Space," *Space and Society: Challenges and Choices*, Vol. 59, Science and Technology Series, an American Astronautical Society Publication, available from Univelt, Inc., P.O. Box 28130, San Diego, CA 92128.
Includes an analysis of the economic implications of the Moon Treaty.

UNITED NATIONS TREATY:
AGREEMENT GOVERNING THE ACTIVITIES OF STATES
ON THE MOON AND OTHER CELESTIAL BODIES

Article XI

1. The moon and its natural resources are the common heritage of mankind which finds its expression in the provisions of this agreement in particular in paragraph 5 of this article.

2. The moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means.

3. Neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any state, international intergovernmental or non-governmental organization, national organization or non-governmental entity or of any natural person. The placement of personnel, space vehicles, equipment facilities, stations and installations on or below the surface of the moon, including structures connected with their surface or subsurface, shall not create a right of ownership over the surface or the subsurface on the moon or any areas referred to in paragraph 5 of this article.

4. States Parties have the right to exploration and use of the moon without discrimination of any kind on the basis of equality, and in accordance with international law and the terms of this Agreement.

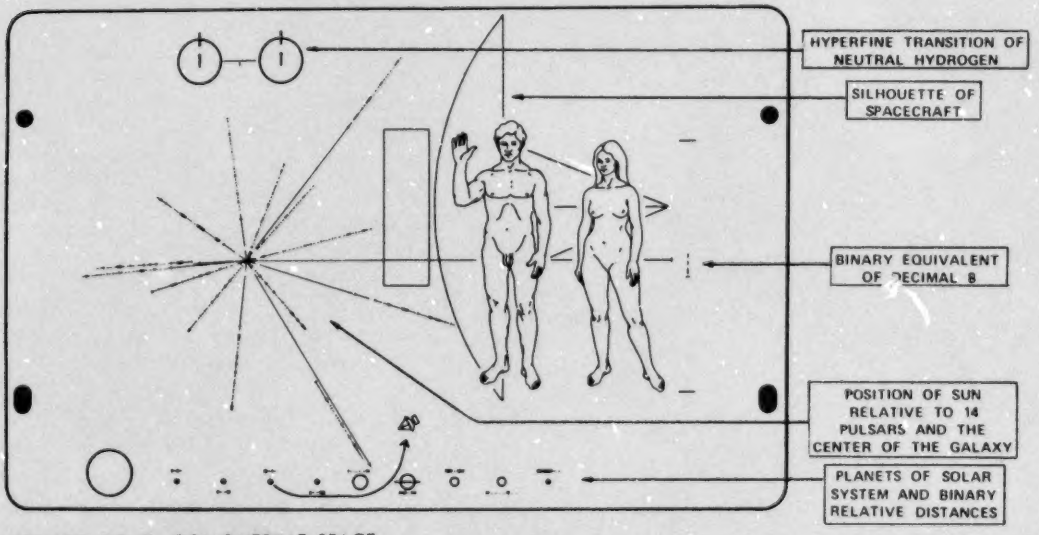
5. States Parties to this Agreement hereby undertake to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the moon as such exploitation is about to become feasible. This provision shall be implemented in accordance with article XVIII of the Agreement.

6. In order to facilitate the establishment of the international regime referred to in paragraph 5 of this article, States Parties shall inform the Secretary General of the United Nations as well as the public and the international scientific community to the greatest extent feasible and practicable of any natural resources they may discover on the moon.

7. The main purposes of the international regime to be established shall include:
(a) The orderly and safe development of the natural resources of the moon;
(b) The rational management of those resources;
(c) The expansion of opportunities in the use of those resources;
(d) An equitable sharing by all States Parties in the benefits derived from those resources, whereby the interests and needs of the developing countries as well as the efforts of those countries which have contributed either directly or indirectly to the exploration of the moon shall be given special consideration.

FIGURE 1: THE PIONEER PLAQUE

Considerable controversy surrounded this message from earth to extraterrestrials. Some called it interstellar pornography; others felt the woman should be holding her hand up as a sign of peace rather than the man. (For an explanation of the message, see the article by Sagan and Drake.)


HYPERFINE TRANSITION OF NEUTRAL HYDROGEN
SILHOUETTE OF SPACECRAFT
BINARY EQUIVALENT OF DECIMAL 8
POSITION OF SUN RELATIVE TO 14 PULSARS AND THE CENTER OF THE GALAXY
PLANETS OF SOLAR SYSTEM AND BINARY RELATIVE DISTANCES